U.S. Department of Transportation

Alternative Solutions to Railroad Impacts on Communities

Phase II Case Studies

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Minnesota Department of Transportation
North Dakota State Highway Department

ALTERNATIVE SOLUTIONS TO RAILROAD IMPACTS ON COMMUNITIES

CASE STUDIES

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FOR

MINNESOTA DEPARTMENT OF TRANSPORTATION

NORTH DAKOTA STATE HIGHWAY DEPARTMENT

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TABLE OF CONTENTS

PHASE II SUMMARY REPORT

BACKGROUND

This report presents the results of the second phase of a study that identifies community problems arising from conflicts between railroad operations and community activities and evaluates possible solutions to these conflicts. The study was initiated as a result of (1) the formation and activities of the Rail Traffic Task Force, a voluntary group of Minnesota and North Dakota communities organized to identify and resolve railroad/community conflicts, and (2) the increasing national significance of the coal train impact issue.

The study corridor, shown in Exhibit 1, is the Burlington Northern, Inc., main line corridor from Beach, ND through Fargo, ND and

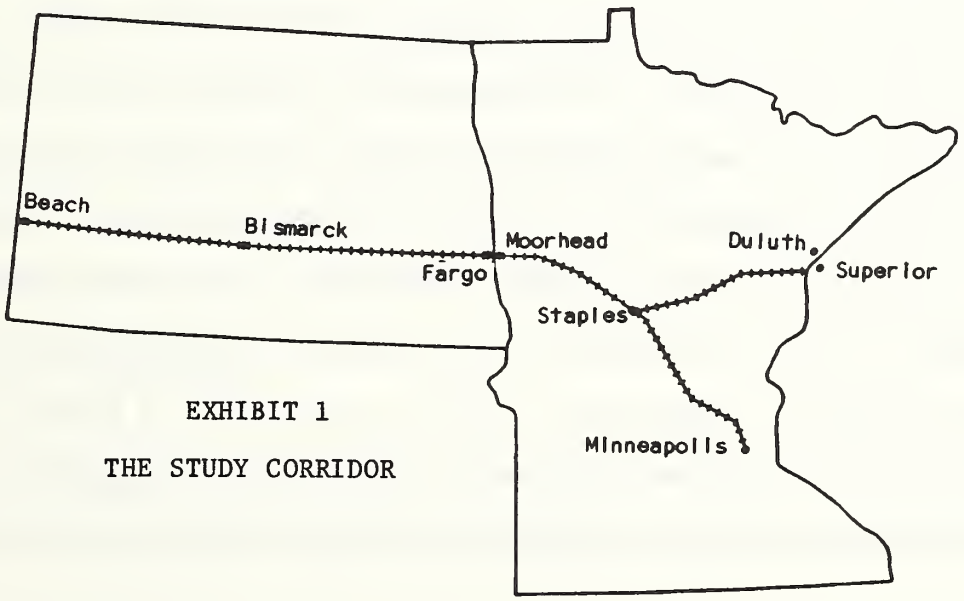

EXHIBIT 1

THE STUDY CORRIDOR

Moorhead, MN to Staples, MN, and then branching to the vicinity of Minneapolis and Duluth, MN.

In 1976, the Rail Traffic Task Force was formed. Its members recognize that Burlington Northern, Inc. has had a substantial, positive effect on the approximately 80 communities located along the corridor, for many years serving as a major employer and providing essential freight transportation links to the rest of the country. The railroad continues to play a vital role in the development and well-being of these communities.

On the other hand, the presence of the railroad main line within communities and local rail operations have conflicted with community activities. The Task Force has contended that the increase in coal traffic along the corridor has intensified the conflicts. Task Force members, as well as community residents, are concerned that if projected increases in coal traffic occur, the conflicts will become even more serious. The concerns and actions of the Task Force are largely responsible for initiating this study.

The efforts of the Task Force and the commitment of the states of Minnesota and North Dakota and the Burlington Northern, Inc. to address community problems attracted the attention of the U.S. Departments of Energy and Transportation. The Departments saw an opportunity to conduct a prototype study of community impacts of railroad operations, particularly of unit coal train operations. As coal has come to play a more significant role in meeting the nation's energy requirements, the community impacts of increased unit coal train movements have become a growing concern of the federal government. Consequently, the U.S. Departments of Energy and Transportation have joined the Minnesota Department of Transportation, the North Dakota State Highway Department, Burlington Northern, Inc. and the

Rail Traffic Task Force in jointly sponsoring this study. A study Management Board, on which each study participant is represented, is responsible for policy guidance and approval of study results and products.

STUDY OBJECTIVE AND APPROACH

The study objective is to find low-cost solutions to the impacts of railroad/community conflicts occurring along the study corridor. To accomplish this objective, a three-phase work program is being conducted:

- In Phase I, a corridor-wide survey of rail/community conflicts was made. Problems were identified by community and a preliminary list of low-cost actions deemed to be potential solutions was developed.
- In Phase II, an in-depth analysis of problems in six representative corridor communities was conducted. Alternative low-cost actions to resolve the problems were identified and analyzed. Phase II culminated with selection of remedial actions to be implemented in each case study community as demonstration projects.
- In Phase III, the demonstration projects will be implemented and evaluated. The purpose of this phase is to establish the actual effectiveness of the projects in resolving problems and to determine the projects' applicability to other corridor communities.

This report summarizes the findings of Phase II. Phase I results are presented in a separate report, available on request from the Minnesota Department of Transportation (Mn/DOT). Also available from Mn/DOT are technical reports that provide detailed information on the methodology and results of each study phase.

CASE STUDY COMMUNITIES

The purpose of Phase II is to develop a better understanding of community problems resulting from rail/community conflicts and to identify

potential low-cost solutions. The approach entailed an in-depth analysis of problems and alternative solutions in six case study communities:

- Beach, North Dakota (pop. 1,400)
- Casselton, North Dakota (1,800)
- Elk River, Minnesota (7,000)
- Hebron, North Dakota (1,100)
- Moorhead, Minnesota (30,000)
- Sauk Rapids, Minnesota (5,800)

The communities are representative of other corridor communities in terms of characteristics, problems, causes of problems, and potentially effective low-cost solutions.

PROBLEMS CONFRONTING COMMUNITIES

The case studies focused on the problems designated as priorities by each community. The problems investigated include emergency vehicle delays; vehicle and pedestrian safety; access problems in traveling to work, school, business, and shopping; and community development constraints. Environmental disturbances were not investigated. Although some residents perceive environmental disturbance as a serious problem, most residents rank this problem low among other problems. None of the case study communities designated it as a priority problem area. Problem designations by community are indicated in Exhibit 2.

ESTIMATES OF PROBLEM MAGNITUDES

Estimates of the current and future (1985) magnitude of priority problems in each community were made to represent the repercussions of

EXHIBIT 2

CASE STUDY COMMUNITY PRIORITY PROBLEMS

CASE STUDY COMMUNITY	PRIORITY PROBLEMS						
	EV	VS	PS	AWS	ABS	CD	EN
Beach, ND	X	X	X	X			
Casselton, ND	X	X	X				
Elk River, MN	X	X		X			
Hebron, ND	X	X	X	X	X		
Moorhead, MN	X			X		X	
Sauk Rapids, MN	X	X					

KEY

EV = Emergency Vehicle Delay
VS = Vehicular Safety
PS = Pedestrian Safety
AWS = Access to Work/School
ABS = Access to Personal Business/Social Activities
CD = Community Development
EN = Environment

An "X" designates the problems identified by community residents and officials as priority concerns.

rail/community conflicts and to provide the basis for evaluating remedial actions. Estimates of current problem magnitudes are presented in Exhibit 3. These figures are estimates of community-wide problem magnitudes and are subject to the limitations of the data and methods used to develop them. They are representative of the order of problem magnitude in each case; they are not precise measures of problem size or intensity.

The estimates presented in Exhibit 3 reveal a wide range of experience among the communities on an absolute scale. On a per capita basis, however, the relative magnitude of the problems is less diverse. Also, the rank order of communities by problem magnitude changes when per capita rather than absolute statistics are used, as can be seen in Exhibit 4. For example, in terms of absolute problem magnitude, Moorhead has the highest number of estimated vehicle delays, about 20 times more than the community with the smallest number of potential vehicle delays (Hebron). In per capita terms, Casselton has the highest number of estimated delays--two and one-half times the estimate for Moorhead, which has the lowest per capita estimate. Similar comparisons may be made between the absolute and per capita magnitude estimates of other problems.

These comparisons illustrate the importance of using per capita as well as absolute estimates when evaluating problem severity in communities. It suggests that a community with a seemingly small absolute problem magnitude may be as adversely affected by rail/community conflicts as a community with a significantly higher absolute problem magnitude. Thus, absolute estimates alone are insufficient to assess the relative problem magnitude among communities.

EXHIBIT 3

ESTIMATES OF CURRENT PROBLEM MAGNITUDES IN CASE STUDY COMMUNITIES [1/]

COMMUNITY	EMERGENCY VEHICLE DELAYS PER YEAR			AUTO/TRAIN ACCIDENTS PER YEAR 6/	ACCESSIBILITY (DELAY PER YEAR AT CROSSINGS)			COMMUNITY DEVELOPMENT (DELAY AT CROSSINGS PROVIDING ACCESS TO THE CBD)		
	Ambulance 2/	Fire	Police		Vehicles	Vehicle Hrs	Person Hrs 3/	Vehicles	Vehicle Hrs	Person Hrs
Beach, ND	0.9	0.6		0.3	57,000	2,000	2,800	NA	NA	NA
Casselton, ND	20.0	0.8		0.8	125,000	3,700	5,200	NA	NA	NA
Elk River, MN	18.0	10.0		0.3 5/	245,000	9,800	13,700	NA	NA	NA
Hebron, ND	2.0	0.3		0.4	43,200	1,700	2,400	NA	NA	NA
Moorhead, MN	91.0	27.0	300.0	2.5	840,000	36,000	50,300	560,000	22,700	32,700 4/
Sauk Rapids, MN	33.0	0.7		1.0	284,000	5,700	7,900	NA	NA	NA

1/ Please note that these are estimates of the order of problem magnitude. The estimates appear reasonable but are not statistically variable. Also, NA is not applicable; blank spaces mean that a reasonable estimate of problem magnitude could not be developed. No credible estimate of potential pedestrian/train accidents could be developed. Consequently, this problem area is excluded from this exhibit.

2/ It is not possible to estimate with any confidence how many of these delays may be critical to the patient. Previous research suggests that about five percent of the patients confront a life-threatening situation prior to receiving medical attention; about one percent of the patients traveling to the hospital confront a life-threatening situation. However, it is not possible to determine in how many of these cases a delay of the character estimated for these communities will be critical. No critical delays to date have occurred in any of the communities to our knowledge.

3/ Assumes 1.4 persons per vehicle.

4/ Includes delays to transit users.

5/ Residents also are concerned about the safety hazard at the intersection of a local street and a trunk highway created by traffic congestion at the nearby grade crossing during train operations. Average accident experience is 8 per year at this intersection.

6/ Because the equations used to estimate auto/train accidents are based on national data, and due to the difficulties associated with estimating grade crossing accidents, the estimates must be regarded as representing the order of magnitude of what may occur in the communities. They should not be regarded as accurate predictions of what will inevitably occur.

EXHIBIT 4

PER CAPITA MAGNITUDE OF SELECTED
CASE STUDY COMMUNITY PROBLEMS

COMMUNITY	PER CAPITA PROBLEM MAGNITUDE 1/ (Number Per Average Year)		
	Ambulance Delays	Vehicles Delayed	Auto/Train Accidents
Beach, ND	.0006	36	.0002
Casselton, ND	.0111	69	.0004
Elk River, MN	.0026	35	.0001
Hebron, ND	.0006	29	.0004
Moorhead, MN	.0030	28	.0001
Sauk Rapids, MN	.0056	48	.0002

1/ Community populations are:

Beach	1,400
Casselton	1,800
Elk River	7,000
Hebron	1,100
Moorhead	30,000
Sauk Rapids	5,800

RAILROAD OPERATING CHARACTERISTICS

An important component in estimating problem magnitudes and in identifying remedial actions is the profile of railroad operating characteristics. Exhibit 5 presents some of these characteristics for the case study communities.

A review of operating characteristics points to a significant conclusion: rail/community conflicts are not solely related to the number of train operations conducted in a community but to other railroad operating and community characteristics as well. For example, while both Elk River and Sauk Rapids experience 25 trains on the average day, the percentage of the day that crossings are blocked on average in Elk River is twice that of Sauk Rapids. The difference is in types of trains, types of operations, and train speeds.

As noted, community characteristics also are an important determinant of the magnitude of rail/community conflicts. Using the Elk River/Sauk Rapids example, in which blocked crossing time in Elk River is twice that of Sauk Rapids, it would seem that problem magnitudes would be larger in Elk River. This is not the case, however, because Sauk Rapids' development patterns cause community activities to conflict more frequently with train operations than those in Elk River (see Exhibits 3 and 4).

These comparisons verify the Phase I conclusion that community problems experienced along the corridor result from the interaction of railroad operations and community characteristics; they are not caused solely by railroad activities. The comparisons also reveal that simple indices of rail operations (such as train volumes) and community characteristics (such as population or daily traffic volumes) may distort

EXHIBIT 5

CURRENT RAILROAD OPERATIONS IN THE CASE STUDY COMMUNITIES

Case Study	Trains Per Day 1/ Average	Trains Per Day 1/ Range	Ave Length (cars)	Speed (mph) Average	Speed (mph) Range	Train Operations 2/	% of Day Crossings Are Blocked 3/
Beach, ND							
Coal	13	0-17	104				3.2
Mixed Freight	5	0-11	80	N/A	N/A		0.7
Local	1	0-3	10				0.4
Total	19	1-23	90	27	13-45	T,S,M,CB,O	4.3 4/
Casselton, ND							
Coal	9	2-16	104	28	15-45		2.3
Mixed Freight	18	11-26	82	24	5-45		5.4
Local	4	0-5	12	5	1-10		1.9
Total	31	25-42	84	24	1-45	S,M,O,I,CB,T,A	10.4
Elk River, MN							
Coal	3	2-9	106	27	17-37		1.0
Mixed Freight	18	14-28	83	25	6-42		4.3
Local	4	1-7	11	6	3-14		3.0
Total	25	23-36	83	22	3-42	T,S,I,O,A	8.4
Hebron, ND							
Coal	13	1-18	104				2.0
Mixed Freight	5	3-12	80	N/A	N/A		0.7
Local	1	0-3	10				0.8
Total	19	6-25	89	35	6-44	T,S,M,CB,O	3.5 4/
Sauk Rapids, MN							
Coal	3	1-12	106	40	10-40		0.5
Mixed Freight	20	12-29	83	38	9-50		3.3
Local	2	0-4	11	21	5-40		0.2
Total	25	13-45	83	38	5-50	T,M,I	4.1
Moorhead, MN (NP)							
Coal	6		104	26	11-25		1.4
Mixed Freight	13		82	20	1-25		3.5
Local	2	N/A	12	24	1-25		0.4
Total	21		84	22	1-25	S,T	5.8
(GN)							
Coal	2		104	11	1-25		0.8
Mixed Freight	4		82	15	1-25		1.1
Local	2	N/A	12	16	1-25		1.0
Total	8		84	14	1-25	S,T	3.4
(21st Street)							
Coal	7	2-12	104	21	6-25		2.0
Mixed Freight	17	13-22	82	17	6-25		4.6
Local	2	0-5	12	18	1-25		0.9
Total	26	23-36	84	18	1-25	S,M,O,I,T,A	7.5

1/ Represents the number of trains operating in the community per day, not the number of operations conducted by trains per day. Thus, a train that enters and exits a crossing more than once per day is counted only once. The estimate of blocked crossing time, however, accounts for multiple operations by a single train.

2/ Operations conducted include switching (S), train meets (M), receipt of orders (O), inspection (I), crew breaks (CB), testing (A), through movements (T).

3/ Totals may exceed the sum of blocked time by train type due to crossings closed (i.e., signals activated) in the absence of a passing train.

4/ These figures are based on experience subsequent to implementation of BN actions to reduce crossing blockage; the most significant of these actions is breaking of trains stopped in crossings. It is estimated that the percentage of blocked time would be 30% to 50% higher than shown above without implementation of the actions.

an accurate assessment of absolute and relative problem magnitude among communities.

EFFECTS OF UNIT COAL TRAINS ON COMMUNITY PROBLEMS

The adverse community impacts of unit coal trains is of particular concern to communities in the study corridor as well as to communities in other corridors that currently experience or are projected to experience large volumes of unit coal trains. Phase II analyses indicate that coal trains indeed contribute to the magnitude of problems experienced in case study communities. More specifically, the railroad's contribution to delay-related problems attributable to coal trains is approximately as follows:

Beach, ND - 75%
Casselton, ND - 25%
Elk River, MN - 12%
Hebron, ND - 60%
Moorhead, MN - 25%
Sauk Rapids, MN - 12%.

As discussed earlier, the differences among communities are functions of the number and type of coal train operations relative to other train operations.

The number of coal trains operating in the corridor will continue to increase. This will contribute, along with further growth in corridor communities, to a worsening of rail/community conflicts. But, a dramatic worsening of the conflicts will not occur in the near term, as some have predicted.

Projections based on Phase I data reveal a potential increase by 1985 of six unit coal trains per day west of Casselton, North Dakota and two to three per day east of Casselton. An addition of one mixed freight

train per day east of Casselton also is projected. A more recent examination of electric utility contracts to purchase coal suggests that these projections of train movements may be higher than the increases that will be experienced by 1985.

In the case study communities, if no mitigating actions are taken, the estimated increase in delay-related problems resulting from the addition of two to six trains per day and additional community growth is 5 percent to 20 percent in Casselton and communities east; a 25 percent increase in problem magnitude is projected for Beach and Hebron. Applying these percentage increases to current estimates of problem magnitude indicates that an important but not substantial increase in that magnitude may occur by 1985. The greater uncertainty associated with projections beyond 1985 makes estimates of rail/community conflicts farther into the future highly conjectural.

FOCUS ON LOW-COST SOLUTIONS

Grade separation or rail relocation are often proposed as solutions to rail/community conflicts, but both are expensive. A grade separation costs upwards of $2 million to construct. In Moorhead alone, a set of nine grade separations were estimated to cost over $28 million in 1975.1/ In Sauk Rapids a single grade separation at the TH-152/Benton Drive intersection is estimated to cost $6 million.

Rail relocation often is even more expensive. The average capital cost of rail relocations in 12 cities (sponsored by the Federal

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1/ Metropolitan Auto-Rail Study, Fargo-Moorhead Metropolitan Council of Governments, prepared by Bather-Rinrose-Wolsfeld, 1975.

Highway Administration as demonstration projects) is $55 million per project. The cost range is $3 million to $114 million. These estimates do not include additional railroad operating cost that could result from the rerouting of trains.1/

As can be seen, the costs of grade separations and rail relocations are high. The cost of applying these solutions on a corridor or state basis is enormous. There are almost 80 communities in the corridor studied, and it is only one of several in the nation that deserve attention to alleviate rail/community conflicts. Thus, the focus of this study is on identifying low-cost ways to resolve conflicts.

ANALYSIS OF LOW-COST ALTERNATIVES

The identification and evaluation of low-cost alternatives began in Phase I with development of a list of actions thought to be low in cost and capable of resolving rail/community conflicts. During the Phase II case studies, this list was expanded. The actions identified include changes in rail facilities and operations, changes in community services and facilities, establishment of railroad/community communication systems, public education programs, and redirection of community development patterns. A list of alternatives was compiled for each community.

The alternatives were evaluated in four steps. First, the alternatives were screened; those determined to be infeasible, ineffective, or of no demonstration value were eliminated. Second, the remaining alternatives were compared in terms of relative problem-solving

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1/ Information provided by the Railroads and Utilities Branch of the Federal Highway Administration.

effectiveness, implementation cost, institutional considerations, and effects on other problems and community or railroad conditions. Third, the results of the analyses were presented to the case study communities to determine which were acceptable or unacceptable for implementation and the priority ranking for the acceptable actions. Finally, the Management Board selected the actions warranted for implementation as demonstration projects based on the information generated in the previous three steps. Exhibit 6 lists the actions investigated during Phase II and the problems each is designed to address. The exhibit designates the actions selected for implementation as demonstration projects.

DEMONSTRATION PROJECTS

Twenty actions or sets of actions were selected for implementation as demonstration projects. The actions include both rail-oriented and community-oriented changes. The projects are designed to address the priority problems identified by the communities. Potential effectiveness of the projects varies by project type and by community. With some projects, only a 10 percent reduction in problem magnitude is expected; with others the problem may be eliminated entirely. The total cost to implement the projects is estimated at $3.2 million. The average project cost is $160,000 and half of the projects will cost less than $60,000. The range in cost by community is $220,000 to $1,100,000.

The following pages contain a brief description of each project, the communities in which it will be implemented, its estimated effectiveness, and its implementation cost.

EXHIBIT 6

ACTIONS INVESTIGATED AS POTENTIAL LOW-COST SOLUTIONS TO THE PRIORITY PROBLEMS IN THE SIX CASE STUDY COMMUNITIES

ACTION	PROBLEMS THE ACTIONS ARE DESIGNED TO ADDRESS IN THE CASE STUDY COMMUNITIES						SELECTED FOR DEMONSTRATION
	EV	CD	AWS	ABS	VS	PS	
RAILROAD OPERATING CHANGES							
Ensure standing trains do not unnecessarily activate the gates and flashers by stopping the trains short of the activation circuit, thereby eliminating unnecessary delays at crosaings.		X	X	X	X		
Increase maximum allowable train speed through communities to reduce the amount of time crossings are blocked and vehicles delayed.	X	X	X	X			X
Ensure that trains using sidings stop well clear of the crossings to avoid unnecessary crossing blockage and to avoid creating a visual obstruction of other approaching trains on parallel tracks.	X		X	X	X		
Schedule local switching operations to off-peak hours to reduce the number of motorists who will experience crossing delays		X	X	X			
Allow delayed vehicles to clear the crossing periodically while switching operations are being conducted.			X	X			
Break trains that must straddle crossings for several minutes to avoid excessive vehicle delays.	X		X	X			
Redistribute trains from one mainline to another; the mainlines are parallel but separated by a few hundred feet; the mainline to which trains would be distributed affects fewer people than the other.		X	X	X			
Relocate crew change points outside of or farther from the community to reduce the crossing delays associated with stopping the train.	X	X	X	X			
Reroute trains around communities using existing tracks.	X	X	X	X			
Relocate the train verifier farther from the community to eliminate slow train speeds in the community as the by-check operation is conducted.	X	X	X	X			
RAILROAD FACILITY CHANGES							
Install grade crossing predictors to activate the gates at crossings in order to reduce early signal activation, thus reduce delays and hazards at crossings.	X	X	X	X	X	X	X
Extend crossing gate arms to prevent motorists from crossing the mainline when the gates are down.					X		
Install automatic gates at crossings in place of less effective grade crossing protection devices.					X		X
Alter rail sidings to eliminate blockage of crossings while trains use the sidings and to permit faster train speeds through the community while entering/exiting sidings.	X		X	X	X		X
Construct fencing along rail right-of-way to inhibit pedestrians from crossing at unprotected locations.						X	X
Straighten track alignment to permit faster train speed through the community.	X	X	X	X			
Improve maintenance of the grade crossing surface.					X		
COMMUNITY FACILITY CHANGES							
Implement street and highway improvements designed to reduce delays at crossings and nearby intersections congested by vehicles delayed at crossings.			X	X	X		X
Remove visual obstructions along the rail right-of-way near crossings.					X		
Close selected hazardous highway/rail grade crossings.					X		X
Construct new crossings at both ends of the community as alternative routes for emergency vehicles only.	X						
Construct a grade separated pedestrian crossing.						X	

EXHIBIT 6 (continued)

ACTIONS INVESTIGATED AS POTENTIAL LOW-COST SOLUTIONS TO THE PRIORITY PROBLEMS IN THE SIX CASE STUDY COMMUNITIES

ACTION	PROBLEMS THE ACTIONS ARE DESIGNED TO ADDRESS IN THE CASE STUDY COMMUNITIES						SELECTED FOR DEMONSTRATION
	EV	CD	AWS	ABS	VS	PS	
COMMUNITY SERVICE CHANGES							
More strictly enforce laws against crossing the tracks, violating activated warning signals.					X		
Upgrade ambulance service from a basic life support to an advanced life support system; this increases the ability to stabilize patients at the emergency scene and thus reduces the probability that a delay in traveling to the hospital will be critical.	X						
Equip fire service volunteers with personal equipment to conduct emergency operations prior to engine company arrival, thus reducing the adverse effects of crossing delay to the engine company.	X						
Establish emergency services on both sides of the mainline.	X						
Provide ambulance and fire service vehicles on both sides of the mainline.	X						
Relocate the emergency stations to the side of the mainline on which the majority of emergency calls occur, thus minimizing potential delays.	X						
Reroute school buses to avoid more hazardous crossings.					X		
Use alternative routes to respond to emergencies when first choice crossings are blocked by slow moving or standing trains.	X						
Establish a volunteer rescue squad to complement the existing ambulance service and to provide emergency medical service stations on both sides of the mainline.	X						X
Establish a volunteer ambulance service to complement the existing private service and to provide emergency medical aervice stations on both sides of the mainline.	X						
Redesign transit bus routes to minimize times the mainline must be crossed.		X	X				
PUBLIC EDUCATION							
Institute pedestrian safety patrols for the safety of children crossing the mainlines on their way.						X	X
Conduct a marketing campaign to overcome people's perceptions of significant access problems to business centers.		X					
Conduct a pedestrian safety education program in the schools.						X	X
COMMUNICATIONS							
Establish an emergency service/railroad communication system to provide the capability to alter trsin operations and avoid blocking designated crossings in emergency situations.	X						X
Improve general community/railroad communications.	X	X	X	X	X	X	X
COMMUNITY DEVELOPMENT							
Direct new development in a way that will minimize future rail/community conflicts.	X	X	X	X	X	X	

KEY:

EV = Emergency Vehicle Delay
VS = Vehicular Safety
PS = Pedestrian Safety
AWS = Acceas to Work/School
ABS = Access to Personal Business/Social Activities
CD = Community Development
EN = Environment

Establishment of an emergency service/railroad communication system will be tested in Elk River, Moorhead, and Sauk Rapids. The purpose of the system is to circumvent or to minimize emergency vehicle delay at crossings. The system would function as follows:

> Equipped with a communication device compatible with those used by the emergency service (e.g., a pagecom or hot line), the local rail agent or train dispatcher would be informed of an emergency call that requires crossing the main line. The agent would determine the necessity and feasibility of changing train operations in or near the community to avoid blocking the predesignated emergency crossing. He would instruct train crews, via the established radio communication system, to change train operations accordingly (e.g., slow down, speed up, or stop).

In Elk River, such a system will be established to reduce delays to the fire service. A 30 percent reduction in fire service delays at crossings is expected. In Sauk Rapids, the system will be used to avoid delays in responding to medical emergencies. Combined with the establishment of a volunteer rescue squad (described below), it may be possible to eliminate entirely crossing delays in traveling to the emergency scene and in traveling from the scene to the hospital. In Moorhead, use of the system will focus on eliminating delays in traveling from the scene of a medical emergency to the hospital when a delay may affect patient outcome. The cost of establishing an emergency communication system is estimated at $1,000 for equipment and $100 to $200 per year for operation and maintenance.

As noted, Sauk Rapids will establish a volunteer rescue squad to reduce delays at crossings in responding to medical emergencies. (In Moorhead, rescue squad service provided by the fire department has been instituted and will be monitored for demonstration data.) A rescue squad consists of people trained in basic emergency medical techniques and

provided with medical supplies and equipment. The rescue squad provides a first response capability only. It is not licensed to transport patients. The squad can stabilize the patient at the emergency scene until the ambulance service arrives. Thus, by locating the squad on the side of the main line opposite the ambulance service, delays in responding to medical emergencies can be eliminated.

The rescue squad has definite economic advantages over establishing duplicate ambulance services. The cost is considerasbly less. An investment of $70,000 may be required to establish a second ambulance service, but a rescue squad will cost about $25,000. Operating costs for the Sauk Rapids volunteer squad may range from $1,000 to $3,000. Operating costs for the Moorhead squad are estimated at $25,000 annually. Sixty to one-hundred hours of training are required for personnel.

Highway intersection improvements will be implemented in Elk River and Sauk Rapids. The improvements are designed to reduce vehicle delays where rail crossings are located adjacent to a major intersection. In Elk River, delays at the intersection are caused when motorists wanting to cross the adjacent main line are blocked from doing so by rail operations. Because of inadequate road capacity for vehicles wishing to turn at the intersection, the vehicles waiting to cross the main line congest the intersection, causing delays to through traffic which would bypass the blocked crossing if road capacity were sufficient. The congestion filters into the adjacent central business district and disrupts business activity. The traffic movements resulting from congestion (frequent stops and starts, use of the wrong lanes to by-pass waiting vehicles) increases the accident potential of the intersection. Another problem at this intersection is the

lack of adequate traffic signal coordination, which sometimes results in trapping motorists between the crossing gates when a train is approaching.

The improvements to be implemented in Elk River will increase intersection capacity within the existing right of way. On-street parking will be removed, allowing turning lanes to be established. The loss of on-street parking will be partially offset through redesign of an off-street parking lot adjacent to the intersection. An improved signal system will be installed to improve the flow of traffic through the intersection and to resolve the "trapped motorists" problem. These improvements will cost about $25,000 and will reduce vehicle delay at the intersection by 15 to 40 percent. Safety conditions also will improve.

In Sauk Rapids, major improvements to the primary intersection in the city are scheduled for implementation. This action was decided independent of and prior to this study. The improvements include widening streets in all directions, changing traffic channelization, introducing a new traffic signalization system and installing grade crossing predictors at the main line crossing just west of the intersections. No estimate of reduction in delay that will result from the improvements has been made.

Alteration of main line sidings will be performed in two case study communities, Beach and Hebron. In Beach, if funding can be developed, siding modifications will include replacement of manual switches with power switches on each end of the siding (with installation of centralized traffic control by Burlington Northern). Operating practices will generally restrict the use of the siding to one train at a time. This latter action is made possible by the scheduled lengthening of sidings east

and west of Beach to accommodate longer trains. The siding changes will reduce vehicle delay at crossings in Beach in several ways. Restricting use of the siding to one train will mean that trains need not block the crossings while occupying the siding. (Currently, when two trains are in the siding, one often must block the crossings because of limited siding capacity.) Installation of a power switch will eliminate the need for the train to be stopped in the town while a crewman throws the lead switch, permitting the train to enter or exit the siding. Remote control provided by power switches will allow trains to maintain speeds up to 25 mph when entering and exiting the siding. Restricting siding use to one train also will allow more siding distance for accelerating and decelerating the train, again resulting in increased train speeds through the town.

Similar results will occur in Hebron, where the siding will be lengthened to permit trains to stop farther from the crossings and provide more distance for acceleration and deceleration. Installation of power switches under BN's proposed centralized traffic control program also will permit faster train speeds entering and exiting the siding through town.

Siding alterations in Hebron will cost $360,000; those in Beach will exceed $200,000. The alterations will result in an estimated 10 to 40 percent reduction in vehicle and emergency vehicle delays in the communities. Pedestrian and vehicle safety are also likely to improve.

Two actions to be demonstrated are designed to improve pedestrian safety. A safety education program will be established in Casselton schools. Of particular concern is the safety of children who cross the main line while walking to and from school and the recently completed public swimming pool. The program will be designed to increase the

precautions taken by children when crossing the main line and it will cost about $1,000 to establish.

In Hebron, a fence will be installed along the railroad right of way to inhibit children and other pedestrians from crossing the main line at locations other than at the depot or at the signalized crossings. The fencing will cost $10,000 to install. Safety patrols for school children also will be established at the crossings at minimal additional cost. Safety improvements are expected to result from these actions, but the magnitude of the improvement is uncertain.

Installation of grade crossing predictors (GCPs) is an action that will be implemented in all six case study communities. At crossings where current protection is provided by flashing lights or crossbucks, automatic gates will be installed along with the GCPs.

GCPs will effect reductions in rail/community conflicts through the elimination of early signal activation. Currently, grade crossing warning signals in the communities are activated by circuits located set distances from the crossings. As the train enters the section of track containing the circuit, the crossing warning signals are activated. The distance of the circuit from the crossing is determined by the maximum allowable train speed through the crossing. That is, the Interstate Commerce Commission requires that crossing signals be activated at least 25 seconds prior to the time the fastest train would arrive at the crossing. This means that trains moving slower than the maximum allowable speed will activate signals in excess of 25 to 30 seconds before train arrival. For example, a train moving at 5 mph may activate the signals in excess of 6 minutes before it enters the crossing. Also, trains that enter the track

circuit and then stop activate the signals until they start again and move through the crossing. The activation of signals a considerable time before train arrival at the crossing is referred to as "early signal activiation."

Early signal activation contributes to rail/community conflicts in three ways. First, it increases the amount of time crossings are closed to vehicle traffic. In some communities, a significant portion of the blocked crossing time (up to 40 percent) is the result of early signal activation. Second, early signal activation has resulted in frequent violation of warning signals by motorists and thus has reduced the credibility and, therefore, the effectiveness of warning signals. Finally, early signal activation is aggravating to community residents and heightens the rail/community conflict in general.

GCPs eliminate early signal activation by determining the speed of the approaching train and activating the signals at a set time internal prior to train arrival at the crossing (usually 25 to 30 seconds). In this way vehicle delay and safety problems associated with early signal activation are reduced.

GCPs could reduce the magnitude of emergency vehicle delays by an estimated 10 to 25 percent; general vehicular delays and associated community development and accessibility problems by 10 to 25 percent, and grade crossing safety hazards by 35 to 70 percent. The safety hazard reductions include cases in which automatic gates are installed in place of less effective protection devices.

The costs of installing GCPs range from $45,000 to $75,000 per crossing. Installation of GCPs with automatic gates may increase the cost

up to $130,000 per crossing. GCPs also cost about $300 more per year to maintain than distance activating circuits; automatic gates may cost about $500 per year more to maintain than lesser devices.

In Moorhead, a set of three actions is scheduled for implementation, principally to reduce access delays to the central business district (CBD). The actions include (1) installation of a power switch to replace the manual switch at the lead to the BN's Dilworth yard just east of Moorhead, (2) changing signal circuitry on the southern main line to permit an increase in the maximum allowable train speed from 25 mph to 35 mph, and (3) installation of grade crossing predictors, also on the southern main line.

The actions will be implemented only on the southern of the two parallel main lines bordering the CBD and separating it from the residential community. The southern line currently experiences 80 percent of the rail operations and separates 75 percent of the population from the CBD. Thus, it was decided to focus efforts on this line. (A more even distribution of trains between the main lines was investigated but found to be expensive and ineffective in reducing CBD access problems.)

It is apparent that an increase in maximum allowable train speed will decrease the amount of time crossings are blocked (thereby the amount of vehicle delay). The power switch also will permit faster train speeds through Moorhead and thus contribute to a reduction in crossing delays. This is accomplished by eliminating the stop/start movements required to operate the existing manual switch and enter the yard. That is, entrance to Dilworth yard used by eastbound, nonlocal trains is currently controlled by a manually operated switch. The existing manual switch requires a train

to stop, a crewman to throw the switch manually, and the train to proceed through the switch and to stop again while the crewman returns the switch to its original position and rejoins the train. The power switch provides for remote control of the switch and permits maintenance of 25 mph while entering into the yard.

Delays in traveling to and from the Moorhead CBD may be reduced an estimated by 30 percent or more as a result of these actions. This should have a positive effect on desired CBD growth. A similar reduction in overall vehicle delay at crossings in Moorhead also is expected. The capital cost of implementing the three actions is $534,000, and the railroad will experience a net operating savings.

In all communities, an effort will be made to improve general community/railroad communications. Discussions with communities while carrying out Phases I and II of the study revealed that there have been misunderstandings, misperceptions, inaccurate data and assumptions, and frustration with communication breakdowns between the community and the railroad. The repercussions of the communication problem were apparent, for example, when some community officials questioned the motivation behind actions taken by the railroad to reduce rail/community conflicts. The resulting confusion heightened community animosity toward the railroad and worsened perceptions of the rail/community conflicts. Similarly, the absence of clear communication channels has led communities either (1) to report problems to the wrong railroad official, resulting in no railroad response to the community complaint or (2) to fail to report problems at all. The resulting frustrations needlessly fuel the rail/community conflicts.

As a result of these experiences, the communities and the railroad have agreed to cooperate in establishing clear channels of communication and more frequent interaction.

A summary of the projects selected for demonstration in the case study communities is presented in Exhibit 7. The exhibit lists the projects to be implemented by community. It also presents a capsulized description of potential project effectiveness and estimated project costs.

PHASE III

After selection of demonstration projects, the study proceeds into Phase III--demonstration project implementation and evaluation. The requirements of Phase III include:

- Obtaining project funding
- Completing detailed project planning and plan approval
- Project implementation
- Project monitoring and evaluation.

Project Funding

As previously noted, implementation of all of the demonstration projects will cost about $3.2 million. This funding was not provided for in the study budget. Consequently, the Management Board must secure the requisite money.

Two approaches could be taken to secure needed funding. One is to identify who should pay for project implementation and to limit the search for funding to these parties. The second approach is more

EXHIBIT 7
SUMMARY OF ACTIONS SELECTED FOR DEMONSTRATION 1/

COMMUNITY	ACTION	POTENTIAL REDUCTION IN PRIORITY PROBLEM MAGNITUDES			ESTIMATED COST	
		EMERGENCY VEHICLE DELAYS	VEHICLE DELAYS3/	ACCIDENTS	CAPITAL	O&M2/ (ANNUAL)
Beach, ND	Install GCPs and gates at the 2nd Ave. and Central Ave. Crossings. 4/	-20%	-20%	-35% (Vehicle Accidents)	$140,000	$1,500
	Shorten the existing rail siding, rearrange trackage and install power switches. Generally restrict siding use to one train at a time.	-10% to -40%	-10% to -40%	Uncertain improvement in vehicle and pedestrian safety	Over $200,000	--
Casselton, ND	Install gates at 3rd and 6th Ave. crossings. Install GCPs to activate warning signals at all crossings. Close the 8th Ave. crossing. Construct a pedestrian grade crossing at 9th Avenue.5/	-15%	-15%	-70% (Vehicle Accidents)	$260,000	Savings of $1,000
	Institute a safety education program in the schools	--	--	Uncertain improvement particularly in pedestrian safety	$500	$500
Elk River, MN	Implement Jackson St./TH 10 intersection improvements	--	-15% to -40%	Uncertain vehicle safety improvements	$25,000	$1,000
	Establish a fire service/ railroad emergency communication system	-30% (fire service delays)	--	--	$1,000	--
	Install GCPs to activate the gates at all crossings (i.e., Proctor, Jackson and Main)	-20%	-20%	-35% (Vehicle Accidents)	$195,000	$1,000
Hebron, ND	Extend the existing siding 1800' to the west; flatten track curvature, and replace the manual switch with a power switch at each end of the siding	-25%	-25%	--	$360,000	--
	Installation of fencing on the north side of the main-line between Elk and Elm Sts. Establish school safety patrols.	--	--	Uncertain pedestrian safety improvement	$10,000	--
	Installation of GCPs and gates at the Elk, Elm and West St. crossings.	-15%	-15%	-50% (Vehicle Accidents)	$260,000	$2,500
Moorhead, MN	Install a power switch to replace the manual switch at the Ollworth yard lead				$59,000	Railroad operating savings up to $9,500
	Install GCPs to activate all crossing signals on the old NP line	-35%	-40%	-35% (Vehicle Accidents)	$435,000	$3,000
	Increase allowable train speed from 25 mph to 35 mph on the old NP line				$40,000	Potential RR savings
	Establish a rescue squad operated by the fire department				$20,000	$25,000
	Establish an ambulance emergency communication system	-100%	--	--	$1,000	$200
Sauk Rapids, MN	Implement intersection improvements at the TH 15 /Benton Drive intersection	--	Uncertain reduction	-35% (Vehicle accidents)	$800,000	$300
	Establish a volunteer rescue squad, and	100%	--	--	$25,000	$3,500
	Establish an ambulance/ railroad emergency communication system				$1,000	$100
	Install gates and GCPs at the 2nd Avenue South, South Broadway and 9th Street South crossings	--	-2%	-60% (Vehicle accidents)	$270,000	$2,400
All	Improve general community/railroad communications	Positive Effect of All Rail/Community Problems			--	--

1/ These actions were selected for demonstration by the study Management Board at the Febraury 7th and 8th meating in Moorhead, MN.
2/ This is the incremental cost associated with each action, e.g., the additional costs above and beyond current O&M costs.
3/ The potential change in general vehicle delays is related to three priority problems identified by the communities: (1) community development restriction (development problems associated with restricted access to specific areas of the community); (2) difficulties in gaining access to work and school; (3) difficulties in gaining access to business and social activities.
4/ GCPs are grade crossing predictors.
5/ Subject to North Dakota Public Service Commission hearing.

pragmatic; it is to seek funding from the sources with the highest probability of contributing to project implementation cost. The approaches are not necessarily mutually exclusive.

The Board takes the position that both the parties contributing to rail/community conflicts and those who will benefit from resolution of the conflicts should participate financially. These parties include all levels of government, the railroad, and rail users. To facilitate progress in this study, however, the Board is pursuing the pragmatic approach.

To assist the Board in its search for funding, existing funding sources were identified and evaluated as to their potential uses for the demonstration projects. Those that appeared most likely to provide funding within a period of time consistent with the study schedule were recommended to the Board as sources that should be investigated.

The results of this effort are presented in Exhibit 8. The exhibit identifies the programs or agencies that fund the types of projects selected for demonstration. Comments on the chances of obtaining funding for the demonstration projects from these programs and agencies also are presented.1/ Essentially, it was found that the federal-aid highway programs are the best public source of demonstration project funding. Many projects are eligible for funding under these programs, including grade crossing improvements, highway/street improvements, fencing, and emergency medical service improvements. (The funds are not available for improvements or actions that are solely rail oriented, such as siding relocations

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1/ Although certain of the funding sources presented in Exhibit 8 were not pursued for demonstration project funding, they may provide funding for actions designed to resolve rail/community conflicts in other contexts.

EXHIBIT 8

PROGRAMS AND AGENCIES CONSIDERED AS POSSIBLE SOURCES OF DEMONSTRATION PROJECT FUNDING

AGENCY[1/]	PROGRAM[2/]	ELIGIBLE PROJECTS	EVALUATION
FmHA	Community Facilities Loans (10.423)	Construction of community facilities that support overall community development such as fire and rescue services, transportation, traffic control, social, health, cultural and recreational benefits.	Do not pursue because the program provides only loans and loan guarantees, not grants.
	Industrial Development Grants (10.424)	Industrial site development in rural areas	Do not pursue since none of the demonstration projects are eligible for assistance under this program.
EDA	Economic Development Grants and Loans for Public Works and Development Facilities (11.300)	Public facilities construction needed to initiate/encourage long-term economic growth	Do not pursue due to questionable project eligibility in qualified communities (Hebron and Sauk Rapids).
	Economic Development-Business Development Loans (11.301)	Long-term business development loans for fixed assets aquisition.	Do not pursue because projects are not eligible.
	Economic Development Technical Assistance (11.303)	Demonstration projects grants, feasibility studies, managerial and operational assistance to solve economic development projects.	Do not pursue due to questionable project eligibility in qualified communities (Hebron and Sauk Rapids)
PHS	Community Health Centers (13.224)	Actions designed to improve availability, accessablity and organization of health care within undeserved areas.	Do not pursue due to questionable project eligibility.
	Health Services Research and Development Grants and Contracts (13.226).	Research, demonstration projects and evaluation activities designed to ensure development of new options for health care services.	Do not pursue due to unlikely project eligibilty.
	Emergency Medical Services (13.284)	Assistance to develop regional emergency medical services; feasibility studies, planning, establishing or improving operations.	Do not pursue because application deadlines and approval dates are inconsistent with the study schedule (next applications not accepted for another year).
	Grants for Training in Emergency Medical Services (13.287)	Costs of training personnel in emergency medical services.	Do not pursue; approval time (6 months) is inconsistent with the study schedule.
HUD	Community Development Block Grants/Entitlement Grants (14.218) Community Development Block Grants/Small Cities Program (14.221)	Wide range of activities directed toward economic development, neighborhood revitalization and improved community services and facilities.	Do not pursue because application deadlines are inconsistent with the study schedule (next applications are due in October).
	Urban Development Action Grants (14.221)	Economic development and neighborhood revitalization projects in severely distressed cities and counties.	Do not pursue; unlikely that projects are eligible.

EXHIBIT 8 (continued)

PROGRAMS AND AGENCIES CONSIDERED AS POSSIBLE
SOURCES OF DEMONSTRATION PROJECT FUNDING

AGENCY	PROGRAM	ELIGIBLE PROJECTS	EVALUATION
DOE	Environmental Research and Impact Assessments	Assessment of impacts of energy development and use through applied research and demonstrations	It is a possibility, although project approval requires 3 to 6 months
FRA	Railroad Rehabilitation Improvement-Guarantee of Obligations (20.309)	Acquisition, rehabilitation and improvement of railroad facilities and equipment	Do not pursue; projects not eligible.
MnDOT or NDSHD	Primary, Secondary and Urban Systems	Construction, improvements and 3R work on the federal aid highway systems	Worth pursuing
	Safer-Off System Roads	Improvement of roads not on the federal aid highway system; includes removal on safety hazards, traffic control devices, pavement construction and reconstruction	Worth pursuing
	Hazard Elimination Program	Projects to eliminate hazards to motorists and pedestrians on public roads	Worth pursuing
	Rail/Highway Crossing Improvements	Protective devices, grade separations, highway relocation and rail relocation	Worth pursuing
	Highway Safety Grants	Implement highway safety standards and conduct safety research	Worth pursuing
OW&UGL	Old West and Upper Great Lakes Technical Assistance Programs (75.002 & 63.002)	Planning, studies, demonstration projects to evaluate needs and develop potentialities of economic growth	Worth pursuing
	Old West and Upper Great Lakes Supplements to Federal Grant-In-Aid (75.003 & 63.003)	Local share of federal aid grant program for construction or equipping of facilities	Worth pursuing depending on other funding obtained.
	Upper Great Lakes Regional Transportation (63.004)	Planning, purchase of equipment, construction and operation of demonstration projects	Worth pursuing
	Upper Great Lakes Energy Demonstration Projects and Programs (63.005)	Demonstration projects concerning energy resource development and impacts	Worth pursuing

1/ The acronyms represent the following agencies: DOE - U.S. Department of Energy; EDA - Economic Development Administration, U.S. Department of Commerce; FmHA - Farmers Home Administration, U.S. Department of Agriculture; FRA - Federal Railroad Administration, U.S. Department of Transportation; HUD - U.S. Department of Housing and Urban Development; MnDOT - Minnesota Department of Transportation; NDSHD - North Dakota State Highway Department; OW - Old West Regional Commission; PHS - Public Health Service, U.S. Department of Health; UGL - Upper Great Lakes Regional Commission.

2/ Numbers in parentheses are the Catalogue of Federal Domestic Assistance Program identification numbers. The Catalogue provides a detailed description of each program.

or increased train speeds.) There is sufficient discretion at the state level to allocate funding to projects in a short time period if unobligated funds are available.

Other public programs that warrant investigation as sources of demonstration project funding are (1) the federal regional commissions, (2) city and county governments, and (3) discretionary funds that may be available to federal agencies. It is recognized that local governments along the corridor have limited financial capabilities. About 80 percent of the communities have populations of under 5,000 people. For such communities, a $5,000 expenditure is a substantial budget item. Consequently, a financial contribution by the local government is not a condition for project implementation. On the other hand, the Board has stated that local government concurrence in closing selected crossings is a substantive contribution. Closing crossings will reduce grade crossing hazards and offset the increased costs that will result from installation of gates and grade crossings predictors at other crossings.

On the private-sector side, the obvious funding source is Burlington Northern, Inc. Certain funding traditions and responsibilities suggest that the railroad is a likely source of funding in several project areas. These areas are grade crossing maintenance and changes in railroad facilities that benefit railroad operations. The railroad also has expressed its willingness to provide the local share of the cost to close crossings as part of the demonstration projects.

To date, the Board has been tremendously successful in securing commitments to fund implementation of demonstration projects. At the time the projects were selected, several were already scheduled for

implementation or already implemented. These projects account for $1.5 million of the $3.2 million total. Since the projects were selected, an additional $1.5 million has been committed, leaving only about $0.2 million to secure. The sources of funding commitments to date include local governments, the states (using principally federal-aid highway funds), and Burlington Northern, Inc.

Although securing demonstration project funding in a short period of time has been possible, implementing a more systematic and extensive program to resolve rail/community conflicts would be extremely difficult if not impossible, given existing program funding levels. Indeed, the struggle to obtain funding was a major motivating force for this study. The study was undertaken to reveal the need to address these problems and, thus, to stimulate increased funding for fulfilling the need.

Project Planning and Implementation

Detailed project planning, plan approval, and project implementation will be accomplished through traditional channels. Exhibit 9 presents the recommended arrangements for implementing projects.

Project Monitoring and Evaluation

The consultant will have the primary responsibility for monitoring and evaluating the demonstration projects. The evaluation will focus on determining the effectiveness of each project in reducing the magnitude of the priority problems it was designed to address. It also will focus on the applicability of the actions to other corridor communities.

EXHIBIT 9

ARRANGEMENTS FOR DEMONSTRATION PROJECT IMPLEMENTATION

PROJECT TYPE	IMPLEMENTATION ARRANGEMENTS
Rail Facility Changes	These changes include siding alterations, installation of power switches and changes required to permit increased train speeds. The decision to implement this type of action rests solely with Burlington Northern (BN). Consequently, BN will assume responsibility for performing the planning associated with the projects and will subsequently implement the projects. Informing the respective cities in which these projects will be implemented of the project design and implementation schedule will enhance ultimate project success and is recommended.
Crossing Improvements	Authorization to implement crossing improvements is a state government function (the Minnesota Department of Transportation and the North Dakota State Highway Department and the Public Service Commission are the responsible agencies). However, the railroad performs the engineering studies to detail the improvement requirements for state agency final approval. The transportation agencies in the respective states then contract the work to the railroad.
Highway/Street Improvements	These projects involve both city streets and state highways. The improvements in Sauk Rapids are funded and scheduled for construction this summer. In the Elk River case, the conceptual project design must be turned into a detailed engineering design. This will be the responsibility of MnDOT. The completed plans must go through the traditional public hearing process and must receive the formal endorsement of the City Council. The project must be incorporated into the MnDOT capital improvement program and MnDOT will arrange for project construction.
Emergency Communication Systems	The establishment of such a system must be developed jointly by BN and the emergency service provider. This coordinated effort is required to establish a system to which both parties are committed. It is recommended that the BN take the lead role in detailing the system since the system will rest on the instructions and authority given to BN agents to direct the alteration of train operations in emergency situations. No formal licensing of the system is required but consideration should be given to involving the state emergency medical services agency in the process.
Rescue Squad	The rescue squad is already established in Moorhead. In Sauk Rapids a volunteer squad will be established under the auspices of the City and in coordination with the existing private ambulance service. The City should therefore assume the lead role in producing the detailed plans for the squad, recruiting and training the volunteers, purchasing and maintaining the equipment and medical supplies. It is recommended that the City seek the technical assistance of the Emergency Medical Services Division of the Minnesota Department of Health. The division has assisted in the establishment of rescue squads elsewhere in the State.
Fencing	The North Dakota State Highway Department will assume responsibility for performing the detailed planning required to install the fencing. The state should seek plan approval by the City of Hebron and subsequently will be responsible for acquiring and installing the fencing.
Safety Education	The City, working with the School Board and teaching staff, must ultimately be responsible for designing and implementing the education program. It is recommended, however, that due to their expertise, the safety division of the North Dakota State Highway Department take the lead role in helping the communities to plan the program and obtain materials. The division also should utilize the expertise and materials of the BN in planning the program.
Community/ Railroad General Communication	Improvement in general railroad/community communication must be the joint responsibility of the BN and each community. It will be the initiative taken by the BN and the communities that will determine the characteristics and content of the communications.

The first component of the evaluation will be to document the characteristics of each project that is implemented. This documentation will specify the actions taken, implementation schedule, and implementation cost. It also will report problems encountered in implementing the projects.

To determine the effectiveness of projects, a before-and-after evaluation framework will be used. A key component of the framework will be to determine the change in problem magnitude indicators (developed in Phase II) resulting from implementation.

The before-and-after data will be supplemented by a log of actual events associated with each problem magnitude indicator. The log will be kept for both the periods before and after project implementation. This information will include, for example, emergency service delays experienced at grade crossings and the consequences of the delays, grade crossing accidents, and observed vehicle delays.

A log of information regarding direct effects of demonstration projects also will be kept. For example, a record will be kept of calls to which the rescue squad responds and whether the service made a difference in patient outcome. Similarly, the number of times the emergency communication system is used, how the system is used, and the results (reduction of delays and effects on patient outcome) will be recorded.

A final component of the data collection effort in Phase III will be to determine whether community perceptions of problem magnitude have changed as a result of the demonstration projects. This is a particularly important measure of project effectiveness. The change in people's perceptions reveals whether a certain amount of change in an indicator of

problem magnitude does indeed make a difference to the community. To determine whether community residents' perceptions have changed, the Phase I mail survey will be repeated. The responses will be compared with those received during Phase I to establish the degree of change that has occurred.

The data collected will provide the basis for drawing conclusions about project effectiveness. The data will be analyzed to determine effectiveness in terms of reduction in problem magnitude. Comparison of results among communities will provide insight into the applicability of projects in different settings.

Phase III is scheduled for completion in December 1980. The results will be documented in a report that will be available from the Minnesota Department of Transportation.

CONCLUSIONS

Phase II has significantly advanced the understanding of rail/community conflicts and of ways in which these conflicts may be addressed. Analysis methodologies have been developed, problem magnitudes have been estimated, the role of unit coal trains has been clarified, and low-cost alternatives have been identified and evaluated.

Most significantly, several projects have been selected for demonstration in case study communities. Review of these projects reveals the exciting potential of low-cost actions in resolving rail/community conflicts. At the same time, such actions will not solve all problems in all communities. In some communities, the actions may merely contain problems while more extensive solutions are designed and implemented. In

other communities, low-cost actions will be ineffective and can serve no function. The Phase II work reveals, however, that low cost actions may reduce or substantially resolve problems in communities. Phase III will more precisely examine potential of low-cost actions through implementation and evaluation of demonstration projects.

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